Lightweight Ultrahigh Temperature CMC-Lined C/C Combustion Chambers, Phase I

Completed Technology Project (2006 - 2006)

Project Introduction

NASA and DoD are seeking economical and high-performance bipropellant thrusters for various applications. These goals cannot be achieved using the silicided C103 chambers in current use. Ultramet has developed and successfully demonstrated carbon fiber-reinforced zirconium carbide (C/ZrC) and carbon fiber-reinforced zirconium-silicon carbide (C/Zr-Si-C) ceramic matrix composites (CMCs) for use in liquid propellant applications up to 4200

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F. Although the density of these CMCs is less than that of C103, further reducing overall weight is desired with a target goal of 2.6 g/cm3. Carbon/carbon (C/C) is widely used because of its light weight and high specific strength at elevated temperatures. However, adequate long-term protection of C/C is the limiting factor for its use in liquid propellant propulsion components. Ultramet will combine the light weight of C/C and the ultrahigh temperature oxidation resistance of C/Zr-Si-C CMCs in a unique laminate composite. This system will possess an overall density that is similar to C/SiC while increasing the operating temperature to 4000

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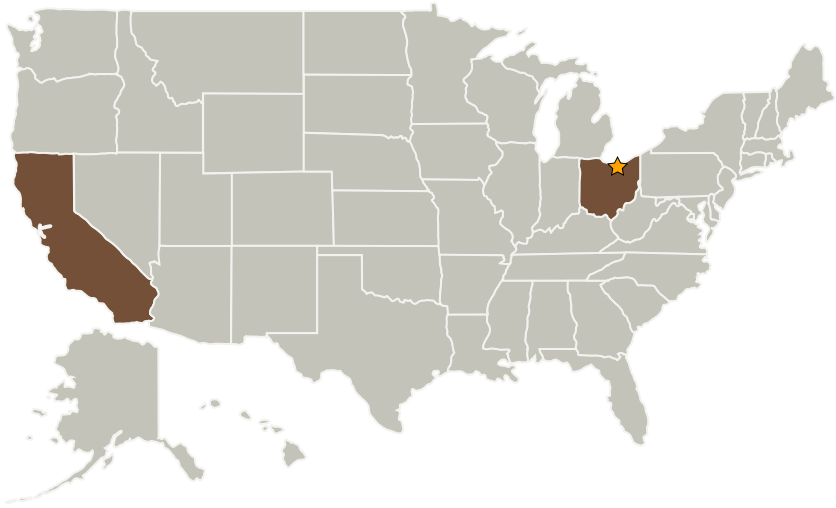
F in liquid propulsion applications. Net-shape fabrication of CMC-lined C/C combustion chambers will be accomplished by adapting an innovative variant of Ultramet's melt infiltration technology.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Ultramet	Supporting Organization	Industry	Pacoima, California

Primary U.S. Work Locations	
California	Ohio

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.4 Solids